ART AND SCIENCE AS INFLUENCES ON THE EARLY DEVELOPMENT OF NATURAL HISTORY COLLECTIONS

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Cabinets of curiosities and treasure chambers, those early antecedents of the natural history collection, may seem to us to have been not at all scientific in their organization or scope and thus to have had little scientific value. Not until the time of Linnaeus and Lamarck do we find collections being used to generate classifications, which has until quite recently been the primary scientific use to which they have been put. But before the collection could serve this or any other scientific purpose it had to be acknowledged that the specimens corresponded to the natural world, that they could represent living entities as they have actually existed. This belief need not involve us in questions about the reality of classifications (important though these have been as determinants of the character of modern collections) because it bespeaks a much more basic presupposition, namely that the external world of living forms was real and thus might be reliably represented by specimens. It was this basic presupposition that the forerunners of the natural history collection helped to establish.

The manner in which individuals perceive their surroundings is greatly affected by their social institutions (Berger and Luckmann, 1966, 19–34 and 121–22). Ecclesiastical institutions dominated early medieval Christian Europe to the extent of claiming and exercising the right to determine which modes of human experience could be designated as real. Abjuring direct means of knowing, the Church aspired to ethical and spiritual accomplishments which could be experienced only indirectly, through symbolism or ritual. As aids to attain-

ing significant spiritual experiences the Church maintained extensive visual arrays of symbolic figures and designs, of which some cathedrals were astonishingly well developed examples, instructing the people and offering them opportunities for sustained emotional involvement. "In ages for which religion and poetry were a common possession, the basic images lived in the conscious mind; men saw their place and destiny, their worth and guilt, and the process of their existence, in terms of them" (Farrar, 1949, 13–14). The material world was significant only as a symbol for a spiritual reality of vastly more consequence. To the author of the twelfth-century *De Bestiis* a dove had two wings as the Christian had two ways of life, active and contemplative. Its eyes were golden because that is the color of ripe fruit and thus of the wise maturity of the church. Its feet were red for the church moved through the world with her feet in the blood of martyrs. Its blue wings reflected thoughts of heaven (Mâle, 1913, 30). One of the most widely known works on the significance of natural objects was the *Physiologus*, a very ancient bestiary presenting symbolic interpretations of animal fables. Symbolism gave a rigorous and all-embracing conception of the world (Huizinga, 1924, 204–5) within which descriptions of natural entities for their own sake were usually mere "interpolations" (Crombie, 1952, 8). The naturalistic techniques of illustration developed during classical times had been virtually lost (Evans, 1933).

The most prominent works of art in churches throughout the Middle Ages reflected the symbolic program, but in lesser works such as decorative architectural details and borders of illuminated manuscripts the artists of the time were free to pursue a more independent course. From sources such as the capitals of columns (Jalabert, 1932) and ornamented books of hours it appears that there gradually developed during the thirteenth century a reinvigorated naturalism, reflecting an increasingly widespread ability to perceive the natural object as an entity in its own right. Around the beginning of the thirteenth century the ornamental foliage of capitals of columns in French cathedrals ceased to be generalized and abstract and came to portray recognizable species of plants. By comparison

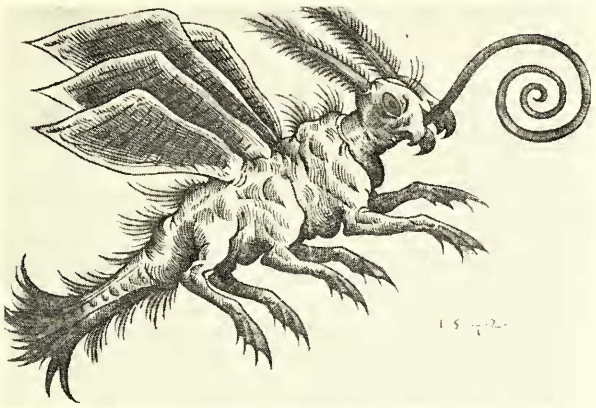

Fig. 1. Anonymous woodcut, "Natürliche Contrafaytung des Herrn oder Künigs der Chavalette," signature and date 1542 added in ink. Border dimensions 18 × 12.5 cm. MS.F13,f88a, Sammlung Wickiana, Zentralbibliothek, Zürich.

to the stylized illustrations of writings on medical topics artists of the time were equally far advanced in their portrayals of skeletons and anatomical features. In general these artistic manifestations of naturalism took place a century or more in advance of naturalistic descriptions or portrayals of organisms by learned writers. It would seem to be a consequence of ecclesiastical control of the most socially important processes of perception that naturalistic portrayal began as a minority tendency on the part of artists rather than writers and other systematic thinkers with whom ecclesiastical authorities were more concerned. Lynn White, Jr. in an important article postulated that these artistic developments were the beginnings of a later and more general shift in attitudes favoring naturalism and more concrete representation even of divine phenomena, as in the eucharistic cult with its tangible sacraments which became prominent at the same time. Such developments, of course, greatly favored the establishment of scientific attitudes (White, 1947, 427–31).

A striking example of the distortions of perception induced by the symbolic view of reality may be found in accounts of periodic European infestations of the migratory locust with illustrations portraying it as a demonic and malevolent crea-

Fig. 2. Monogrammist HW, "Natuerliche Contrafeyhung des gewaltigen flugs der Heuschrecken . . . ," dated 1556. Border measurement 18 × 16 cm. MS.F13,f80, Sammlung Wickiana, Zentralbibliothek, Zürich.

ture. There is an allegorical drawing by Albrecht Dürer (1471–1528) in the Museum at Rennes in which locusts are depicted as devils writing script and carrying various sinister objects (Blanck, 1957, 6). Such an illustration shows the influence of prevailing theological conceptions of the locust as an instrument of divine vengeance. During the plague of 1542 one observer claimed to find the words IRA DEI on the wings of locusts, which he took as evidence that they were indeed messengers of divine wrath (Schönwälder, 1960, 413). After the infestations of 1542 and 1556, each extending through wide areas of Italy and central Europe, woodcuts were made showing locusts as fabulous beings with exaggerated antennae, webbed feet, a forward-pointing spiral appendage (in the 1542 drawing), and brush-like tails (Fig. 1 and 2). These illustra-

Fig. 3. Realistic depiction of migratory locust by Pisanello, ca. 1430. Musée de Louvre, Paris. Photo credit: Cliché des Musées Nationaux.

tions were published as parts of broadsides printed to carry news of the locust plagues and thus may be taken to represent attempts to record the events. There is strong confirmatory evidence that there indeed were plagues of locusts when reported (Baccetti, 1954, 278; Waloff, 1940, 225) yet visualizations strayed exceedingly far from their objective basis. As late as the middle of the sixteenth century it was possible for a would-be chronicler to have before him a locust yet perceive and record a chimera, as the socially derived mode of perception imposed itself upon the data of experience. The early drawings of the locust were frequently so schematized as to be unrecognizable. One of the most experienced students of medieval illuminated manuscripts reproduces two drawings from the late thirteenth and early fourteenth centuries in which peasants are filling sacks with migratory locusts. The captions are erroneously given as "Man and butterfly, pursuing with hood." (Randall, 1966, Pl. LXXI, figs. 342, 343).

In the Louvre there is a drawing executed over a century earlier, by Pisanello (1380–1456), in careful naturalistic detail, clearly recognizable as *Locusta migratoria* and lacking any of the fantastic features attributed by the artists of the later wood-

cuts (Fig. 3). The naturalistic illustration had been far advanced for its day and the later woodcuts may be taken to show a persistence in popular culture of the fabulous tendencies in depictions of creatures influenced by prevalent medieval concepts of reality. This interpretation posits a gradual change in modes of perception by which naturalism appeared first as an esthetic motive in the decorative arts and then grew in importance until it became the basis for more accurate scientific representations of creatures based upon direct observation unhindered by conceptual distortions.

Leonardo da Vinci (1452–1519) exulted in the knowledge he gained from direct observation. It is significant that the most profound Renaissance conception of the scientific value of naturalistic perception was that of an artist, who indeed conceived of painting as the highest form of knowing. Leonardo's avowal that "All our knowledge originates in our senses" (Stites, 1968, 222) sharply contrasts with the verbal procedures by which contemporary academicians still sought to substantiate their beliefs. Leonardo praised the power of drawings to describe a "whole arrangement," far superior to verbal descriptions which conveyed "but little perception of the true shapes of things" (Zubov, 1962, 57). From 1485 he had conducted serious anatomical studies based upon numerous dissections. He advocated consecutive drawings to show how different systems composed an organ and also sequential drawings to depict the same structure from several directions, and he tried also to represent living things in their dynamic aspect. His ideal was the geographic atlas showing all major provinces of a subject. The artist must progress beyond naive perception to discerning visual examination of objects. He must "know how to see" (*saper vedere*). Leonardo was especially contemptuous of beliefs that immaterial spirits, lacking extension and the capacity to exercise force, could intervene in the everyday world. His observations clearly demonstrate the important consequences for scientific knowledge which would follow from learning to see.

One may perhaps mark the turning point in the application of naturalistic perception to biology in the work of Vesalius (1514–1564). In the well-known scene of an anatomical theater

that appears as the title page of *De humani corporis fabrica* (1543) there is a bearded man holding a closed book while pointing to the dissection in progress as though to admonish a nearby student that more is to be learned from reality than books. Indeed, it required only the most cursory observation to demonstrate that men do not lack a rib even though Moses wrote that God took one from Adam or that the human liver does not have the five lobes which Galen ascribed to it.

We might note that the most important forerunner of Vesalius, Giacomo Berengario da Carpi (c. 1460–1530), was praised by Cellini for his interest in art and possessed a considerable art collection. The splendid woodcuts commissioned and perhaps partly executed by Vesalius established the importance of biological illustration, and they reveal something of their artistic legacy in the landscapes of the Euganean Hills near Padua drawn in the background of the plates of "muscle-men," as well as in the poses of the figures, taken from antique statuary. Perhaps mindful of the dissections carried out by the artists Antonio Pollaiuolo (1429–1498) and Benozzo Gozzoli (1420–c. 1497), as well as Leonardo, the recent biographer of Vesalius observes that "The impulse to naturalistic anatomical depiction seems to have come from the art world rather than the medical." We should also note his observation on the extent to which Vesalius owed his success to the reviving naturalistic mode of vision: "Vesalius had an extraordinarily well-developed visual sense, and it is apparent in his verbal descriptions of anatomical structures" (O'Malley, 1964, 18 and 118). The *Historia animalium* of Conrad Gesner (1551) and *De historia stirpium* of Leonhart Fuchs (1542), both profusely illustrated works, were published at about the same time, indicating that the use of realistic illustrations had become established (Nissen, 1963; Ziswiler, 1965; Blunt and Stearn, 1950).

The ability to discern and portray accurately the characteristics of the form of organisms, a talent at odds with the prevailing official mode of the time, owed its origin to artists and illustrators. The further extension of this ability in society would depend upon the extent to which men could learn to see in naturalistic rather than in symbolic terms. The phenom-

enological foundations of biological science were laid by naturalistic artists several centuries before the prevailing views came to ascribe the force of evidence to direct observation and objective portrayal of specimens from nature. Thus we should be on the lookout for new institutions serving to apply the artists' mode of perception to the social enterprise of ascribing reality to man's experience. The cabinet of curiosities, the early forerunner of the natural history collection, served a mediating function of this kind.

In the evolution of natural history collections the visual arts played a role which seems to have been central but which is difficult to define. There were no public museums until the eighteenth century. Scientific collections evolved slowly from the private treasure chambers of nobles and kings. Virtually the only natural objects found in these collections were fabulous or prized for their rarity. In the collection of Jean, Duc de Berry (1340–1416) there was a wonder cabinet with giants' bones, sea monsters, carved crystals, and some genuine articles such as ostrich eggs and polar bear skins. By the sixteenth century there were about a dozen outstanding large collections of princely treasure such as that of Archduke Ferdinand of Tirol (1520–1595) at Schloss Ambras (Schlosser, 1908). In these collections natural history objects were combined with gems cut into natural forms, montages of shells, and decorative items made from natural substances. The word cabinet is used sometimes of the collections as a whole and sometimes of the chests containing smaller items. The Kunst-und-Naturalienkammer set up by the Elector Augustus I (1530–86) of Saxony comprised seven rooms of the Royal Palace in Dresden, with works of both fine and decorative arts intermingled with natural history objects (Wittlin, 1949; Schuster, 1929; Murray, 1904; Bedini, 1965).

One of the most elaborate of the cabinets ever built to store such intermingled collections of nature and art objects is preserved in Uppsala. It was made by Philip Hainhofer of Augsburg (b. 1578), whose paintings and collages are occasionally remembered as examples of optical illusions, many based upon natural form. He was a dealer in natural rarities and art who oversaw the preparation of one celebrated cabinet in 1617

FIG. 4. Gem and art peak of the Gustavus Adolphus Kunstschrank (1625–26). The vessel is 42 cm long and the work of H. C. Lencker, an Augsburg silversmith. From Böttiger, 1910, Plate 12.

for Duke Philipp II of Pomerania, which was brought to Berlin to hold part of the royal collection and destroyed during World War II (Lessing and Brüning, 1905). The Uppsala cabinet, which was prepared in 1625–26, rises in several tiers of ebony drawers and contains numerous doors opening onto facades of cameos and rare woods. It is crowned by a carved coconut, coral, and silver drinking vessel with statuettes of Neptune and Venus atop a distinctive montage of minerals (quartz, citrine, hematite, barite, ores, and semiprecious stones) and shells (Fig. 4).

In the centuries following wealthy private collectors and

FIG. 5. Works of art and natural objects combined in a seventeenth-century collection, painted by Frans Francken the younger (1581–1642), "Eine Kunst und Raritätenkammer" (undated), 74 × 78 cm, Kunsthistorisches Museum, Vienna.

scholars also formed collections. Here, too, we find coins and other antiquities, shells and marine specimens, gems, and paintings indiscriminately jumbled together, as in the remarkable painting by Frans Francken the younger (1581–1642) showing a gentleman's collection and its owner discoursing over books with his friends in an adjoining room (Fig. 5). In the collection of Ulisse Aldrovandi (1527–1605) at Bologna works of art were arranged as ethnological curiosities or as examples of the materials of which they were made while natural objects and imitations were placed together (Schlosser, 1908, 108). An illustration of the collection of the pioneer marine biologist Ferrante Imperato (1550–1625) in Naples shows one wall lined with cabinets for works of art and the

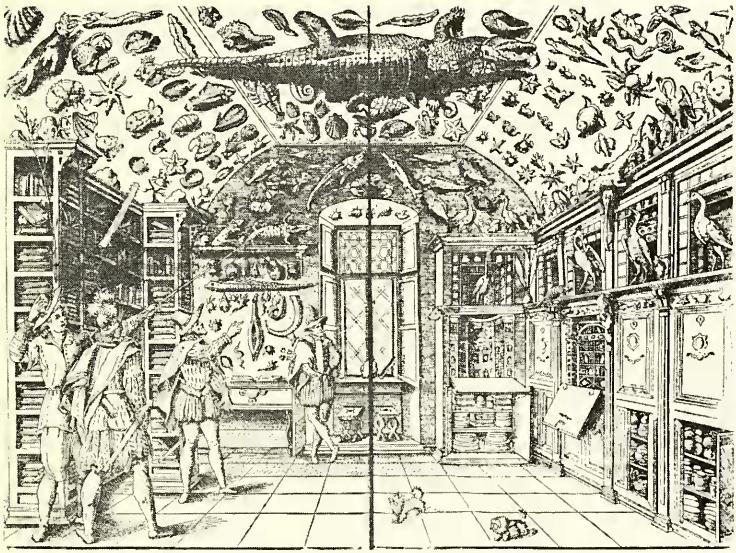

FIG. 6. Objects of art and nature combined in an early collection. Frontispiece, Ferrante Imperato, *Dell'historia naturale* . . . (Naples: C. Vitale, 1599).

ceiling covered with marine productions arranged without regard for their biological affinities (Fig. 6). In 1725 the collection of Sir Hans Sloane (1660–1753), which was to form the nucleus of the British Museum, included 5497 minerals and fossil substances, 804 corals, 8226 vegetable substances, 200 volumes of dried plants, 3824 insects, 3753 shells, 1939 echinoids, fishes, crustaceans, etc., 568 birds and 185 eggs, 1194 quadrupeds, 345 reptiles, 507 human objects, 1169 miscellaneous artificial and natural objects, 302 antiquities, 81 large stone seals, 319 pictures, 54 mathematical instruments, 441 vessels and carved mineral objects, 136 illuminated books, 20,228 coins and medals, 580 volumes of prints, and 2666 manuscript volumes (Murray, 1904, I, 137–38).

The inclusion of the fine and decorative arts in these collections affords a clue to the intricate cultural change that was occurring. The princely collection with fabulous or exceedingly rare animals was gradually succeeded by a collection representative of the animal or plant kingdom. The decorative

objects so important to the early collections dwindle by proportion until by the eighteenth century one finds collections made up exclusively of natural objects. It would seem that the works of art in the collections functioned as catalysts in an unconscious transfer of authority from the artists' perception to the naturalists' reliance upon the objects themselves. We have today none of the collections as they were; objects of art and nature once regarded together have become the separate responsibilities of distinct departments in modern museums (Hutchinson, 1965.) Further study of inventories and descriptions of sixteenth and seventeenth-century collections is surely desirable to clarify and define the effect of art works upon the perception of natural objects and changing conceptions of reality as they have represented it. Such a correlation of the contents of collections with the conceptual development of biology would be a welcome contribution to the history of scientific thought.

Toward the end of the sixteenth and throughout the seventeenth century realistic still-life paintings of flowers and insects became immensely popular in the Low Countries (Bergström, 1956; Warner, 1928; Bernt, 1948). Paintings by Jan Brueghel the elder (1568–1625), Ambrosius Bosschaert the elder (1573–1621), Roelandt Savery (1576–1639), Daniel Seghers (1590–1661), Jan Davidsz. de Heem (1606–1683), Otto Marseus van Schrieck (c. 1619–1678), Abraham Begeyn (c. 1637–1697), Abraham Mignon (1640–1679), Rachel Ruysch (1664–1750), Jan van Huysum (1682–1749), and others frequently portrayed flowers in precise detail with recognizable species of insects situated near them in lifelike poses, while snails and snakes often appear. One of the earliest and most interesting of these painters was Georg Hoefnagel (1542–1600), whose works showed many exotic insects brought to Europe for the first time (Kris, 1927; Bergström, 1963).

The style of these works is usually termed "scientific naturalism." One leading scholar has attributed the realism of Dutch and Flemish flower painting to the "philosophy which claimed that the quality of reality belongs exclusively to the particular things directly perceived by the senses" (Panofsky, 1953, I, 8). The flowers frequently symbolize mortality and sometimes the

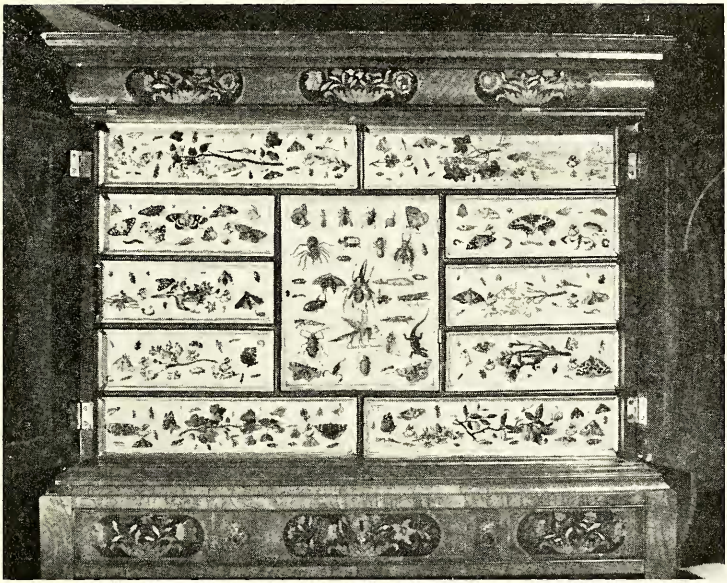

FIG. 7. The painted surface of the Smithsonian cabinet of curiosities, attributed to Jan van Kessel. 42¼ in × 26¼ in. External marquetry decoration appears above and below the painted surface.

insects are allegorical representations (Bergström, 1955), but the overwhelming impression created by these numerous works is one of fascination with their immediate colorful subject matter. They thoroughly document the force and persistence of naturalism as an artistic motive throughout the period of the development of the natural history collection.

In 1964 the Smithsonian Institution acquired some months after its sale at Sotheby's (March 11, lot 88) an exceptionally interesting work in this genre which serves to remind us of the close links between naturalism and cabinets of curiosities (Fig. 7). It is a seventeenth-century veneer and marquetry cabinet, an unsigned work of Flemish or English craftsmanship, with ten drawers and a central door panel whose veneer surfaces are painted white and on which appear scores of insects, painted approximately life-size, after the manner of the well-known Flemish still-life painter Jan van Kessel (1625–1679), who is well represented in major European museums. Many of the

individual insects and even their arrangement in the panel compositions are identical to those in signed works by van Kessel. The entire composition closely resembles that of a set of seventeen paintings on copper signed and dated 1658 bought by the Amsterdam firm Gebr. Douwes in England in 1923 and sold by them to a Mr. van Valkenberg in 1924. This set is probably the same as that sold by the Fievez firm in Brussels in 1935 and that exhibited by the Hallsborough Gallery in London in 1956, and since sold to an anonymous buyer (personal communications from Evert J. M. Douwes and the Hallsborough Gallery; also Hallsborough, 1966). A separate, virtually identical set was exhibited in Amsterdam in 1934 by the firm of P. de Boer and then broken up (personal communication, P. de Boer). Both sets on copper were probably prepared for the fronts of cabinets, either as decoration or explicit commentary on cabinets of curiosities.

The Smithsonian cabinet is not as intricate in detail as most van Kessels; it was probably copied in England from one of the sets on copper or possibly executed in van Kessel's own studio in Antwerp. The latter would be more likely if the place of the cabinet's manufacture could be established as Flanders, but its manner of decoration was virtually an international style, so that it is very difficult to assign individual pieces to one country or another. The dimensions of the Smithsonian cabinet are more regular in inches than in pieds and pouces, the system of measurement in use on the Continent at the time, which suggests that it was fabricated in England. At any rate, its design clearly reflects van Kessel's work of 1658 and the tradition by which naturalism had come to be associated with cabinets of curiosities.

The insects and plants, as was true of most work of the genre, were almost certainly copied from sketchbooks (a practice that enabled artists to produce their works throughout the year, not just when flowers were in bloom and insects on the wing). It is also of interest that van Kessel executed works in which creatures were portrayed almost as in the dioramas of museums (usually considered a nineteenth-century innovation). In the Museé de Dijon are two undated works of this type: one, "L'eau," shows a seal, giant squid, and numerous fish on a

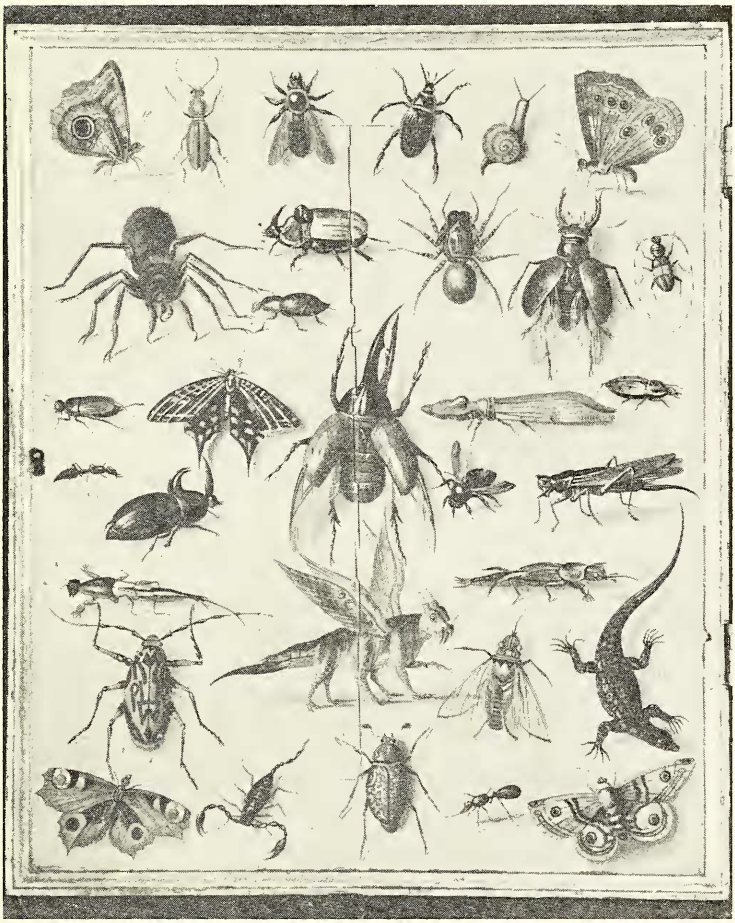

FIG. 8. The central panel of the Smithsonian cabinet of curiosities, attributed to Jan van Kessel. 12⅝ in × 15½ in. The figure derived from the locust woodcuts appears in the lower center.

beach; the other, "La terre," shows stags, peacocks, roses and other plants, and two hawks tearing at a dead game bird. Another painting sold by the firm of Nystaad in Lochem in 1947, entitled "The night," portrays a lively group of bats, badgers, and wildcats in a nighttime landscape.

It is in the central panel of the Smithsonian cabinet, with

exotic insects and arachnids from the Americas (Fig. 8) that we encounter an image which reminds us of the progress made toward naturalistic representation in the century or so preceding. Here, slightly altered, but with unmistakable thickened antennae and forward-pointing spiral appendage is the migratory locust figure seen previously in the sixteenth-century broadsides! Before seeing those earlier illustrations in the Zürich library I had supposed that this was an illustration of a "humbug" fabricated by curio merchants (Misson, 1699, I, 134–35; Ripley, 1965; Ritterbush, 1964, 145 n.). To find the sixteenth-century illustrations of the locust was to discover an unexpected element of continuity linking the fabulous images of a symbolic age to the progress of realistic natural knowledge based upon the objects themselves, but only as a single survival amidst an array of realistic portrayals. If the collection was gradually transformed from an artistic aggregation to a purposeful instrument of scientific inquiry it was because men of science had learned to see, largely as a result of the vivid accomplishments of artists who had so far preceded them in employing naturalistic vision. A treatise on museums and collections published in the early eighteenth century included as its dedicatory legend a verse which seems aptly to summarize this history (C. F. Neickelius, 1727):

What in this world can more delight
Than the nobility of creatures studied as they really are?
What can excite joy and wonder in the soul
More than viewing the reality of nature?

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